General

Guideline Title

ACR Appropriateness Criteria® renal trauma.

Bibliographic Source(s)

Sheth S, Casalino DD, Remer EM, Bishoff JT, Coursey CA, Dighe M, Eberhardt SC, Goldfarb S, Harvin HJ, Lazarus E, Leyendecker JR, Lockhart ME, Nikolaidis P, Oto A, Porter C, Vikram R, Expert Panel on Urologic Imaging. ACR Appropriateness CriteriaÂ® renal trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2012. 7 p. [40 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Sheth S, Francis IR, Casalino DD, Arellano RS, Baumgarten DA, Curry NS, Dighe M, Fulgham P, Israel GM, Leyendecker JR, Papanicolaou N, Prasad S, Ramchandani P, Remer EM, Expert panel on Urologic Imaging. ACR Appropriateness Criteria® renal trauma. [online publication]. Reston (VA): American College of Radiology (ACR); 2009. 5 p.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Renal Trauma

Variant 1: Blunt abdominal trauma with microscopic hematuria; no suspicion of associated abdominal injury.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	5		☢☢☢☢
X-ray abdomen and pelvis	4		☢☢☢
CT abdomen and pelvis without contrast	4	If patient has contraindication to contrast.	☢☢☢☢
US abdomen (FAST scan)	4	To look for free intraperitoneal fluid.	O
CT abdomen and pelvis without and with contrast	3	Images without contrast do not add significant value to CT with contrast.	☢☢☢☢
US kidneys and bladder retroperitoneal	2		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative**

Radiologic Procedure	Rating	Comments	RRL*
X-ray intravenous urography	2		☢☢☢
Arteriography kidney	1		☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Blunt abdominal injury; suspicion of multisystem trauma, with hematuria.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	9	Detection of associated injuries.	☢☢☢☢
X-ray abdomen and pelvis	7	Detection of associated injuries.	☢☢☢
CT abdomen and pelvis without contrast	5	If patient has contraindication to contrast.	☢☢☢☢
X-ray intravenous urography	4	Limited to use in the operating room if patient is too unstable for preoperative CT or if CT is not available.	☢☢☢
Arteriography kidney	4	Embolizing bleeders, avulsion of pedicle.	☢☢☢
US abdomen (FAST scan)	4	To look for free intraperitoneal fluid.	O
CT abdomen and pelvis without and with contrast	3	Images without contrast do not add significant value to CT with contrast.	☢☢☢☢
US kidneys and bladder retroperitoneal	2		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Penetrating abdominal injury; suspicion of multisystem trauma, with or without hematuria.

Radiologic Procedure	Rating	Comments	RRL*
CT abdomen and pelvis with contrast	9		☢☢☢☢
CT abdomen and pelvis without contrast	5	If patient has contraindication to contrast.	☢☢☢☢
X-ray abdomen and pelvis	4	To look for foreign bodies.	☢☢☢
X-ray intravenous urography	4	Limited to use in the operating room if patient is too unstable for preoperative CT or if CT is not available.	☢☢☢
Arteriography kidney	4	Embolizing bleeders, avulsion of pedicle.	☢☢☢
US abdomen (FAST scan)	4	To look for free intraperitoneal fluid.	O
CT abdomen and pelvis without and with contrast	3	Images without contrast do not add significant value to CT with contrast.	☢☢☢☢
US kidneys and bladder retroperitoneal	2		O
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			***Relative Radiation Level**

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

No single method of imaging evaluation can be uniformly applied to all patients suspected of suffering abdominal trauma. The exact approach depends not only on the types of injuries the patient has likely suffered, but also on the philosophy of the attending physicians, local practice, and the type of equipment and support available. Moreover, the evaluation of a suspected renal injury cannot be isolated from the evaluation of other suspected intra-abdominal injuries. A variety of different approaches to a given patient may therefore be acceptable. Nevertheless, imaging plays a crucial role in suspected renal trauma in assessing the extent and severity of injury to the affected kidney, evaluating function and anatomy of the opposite kidney, and detecting other injuries.

Most closed upper urinary tract injury occurs after wide-impact blunt abdominal trauma, usually after sudden deceleration (motor vehicle accident), crash injury (fall from height), assault, or abdominal injury sustained during contact sport. The incidence of penetrating injuries to the kidney from either a gunshot wound or a stab wound is variable but may be associated with more severe renal injuries. Regardless of the mechanism, the majority of serious renal injuries are associated with injuries to other organs that may dominate the clinical picture. Isolated renal injuries after blunt trauma are rare, and the majority are relatively minor in most published series. In one reported series, 241 of 831 patients had what were considered to be solitary renal injuries; however, the vast majority (98%) were minor injuries. Therefore, only five patients in the entire series suffered significant isolated renal injury, but there were 33 significant renal injuries in the group of 590 patients with hematuria who suffered multisystem trauma.

Other injuries associated with injury of the kidneys following multisystem blunt trauma include (in order of decreasing frequency): fractures of the extremities, thoracic injury, pelvic fracture, intra-abdominal injury, head injuries, and diaphragmatic rupture. In the abdomen, injuries to the liver and spleen are most commonly associated with renal injury, followed by injury to the pancreas, the colon, and the small bowel.

Renal injuries are classified into grades 1 to 5 based on the severity of the injury using the American Association for the Surgery of Trauma (AAST) organ injury severity scale:

- Grade 1: Contusion or nonexpanding subcapsular haematoma without parenchymal laceration
- Grade 2: Nonexpanding perirenal haematoma laceration <1 cm deep without extravasation
- Grade 3: Laceration >1 cm without urinary extravasation
- Grade 4: Laceration extending through renal cortex into collecting system, or segmental renal artery or vein injury with contained hemorrhage, or partial vessel laceration, or vessel thrombosis
- Grade 5: Laceration: shattered kidney, or renal pedicle injury, or avulsion of renal hilum

Hematuria is a characteristic sign of renal trauma. However, there is no correlation between the degree of hematuria and the severity of the renal injury. Furthermore some major renal injuries can be present in the absence of hematuria.

The amount of hematuria that should trigger imaging of the urinary tract after localized blunt trauma is controversial. One group of investigators found that significant renal injury was limited to the group of patients in whom shock and either gross or microscopic hematuria was present among 306 individuals analyzed retrospectively following blunt trauma. There were no significant renal injuries among the 221 patients who had microscopic hematuria but were not suffering from shock. In patients in the same series who suffered penetrating injuries, however, no such discrimination was possible, and the authors suggest radiologic evaluation of all patients suffering penetrating injury and any degree of hematuria. These observations have now been confirmed in multiple additional studies, both retrospectively and prospectively. On the other hand, the absence of hematuria does not exclude the presence of a significant renal injury. In a series of 396 patients suffering renal injury after falling from a height, 20.8% (5 out of 24) of patients with grade 2 to 4 renal injuries had no hematuria. In another study of patients with renovascular injuries, the authors reported that hematuria was absent in 18% of cases.

It can therefore be concluded that radiological investigation for potential renal injury is warranted in trauma patients presenting with the following injuries:

1. Blunt abdominal trauma and gross hematuria
2. Blunt abdominal trauma, shock (systolic pressure <90 mm Hg in the field or during resuscitation), or other associated injuries and microscopic hematuria
3. Blunt trauma with injuries known to be associated with renal injury such as rapid deceleration, direct contusion to the flank, flank ecchymoses, or fractures of the lower ribs or thoracolumbar spine, regardless of the presence or absence of hematuria
4. Penetrating trauma to the upper abdomen or lower thorax regardless of the presence or absence of hematuria

Computed Tomography (CT)

CT, especially multidetector CT (MDCT), is the gold standard for imaging hemodynamically stable patients with suspected blunt or penetrating

intra-abdominal injuries. MDCT has been shown to be a rapid and accurate method for detecting the presence of and grading the extent of abdominal injuries, and it allows for optimal treatment planning. A group of researchers published an image-based classification paralleling the AAST renal injury classification which can be useful to the clinicians managing the patient.

As conservative (nonoperative) management has become the treatment of choice for many renal injuries, CT plays a critical role in guiding management. One study reported that early CT evaluation allowed confident nonoperative management in 17 of 22 patients with renal injuries. Another study found nonoperative management was effective in 50% of patients with grade 4 or 5 injuries who were hemodynamically stable. A group of investigators reviewed outcomes in 517 patients with renal artery injuries and reported shorter hospital stays in patients who were observed compared to those treated with nephrectomy or surgical revascularization. Additionally, expectant management has been shown to decrease the number of iatrogenic nephrectomies. Many authorities now believe that with the information afforded by preoperative CT, renal exploration need not be performed unless there are major devitalized fragments or associated bowel or pancreatic injury, or unless the patient becomes hemodynamically unstable from a major renal laceration and is not manageable by angiographic embolization.

CT protocols will vary depending on available equipment and the patient's clinical presentation. However, it is generally agreed that for optimal detection of renal injuries intravenous contrast needs to be administered. In trauma patients, CT images are usually acquired in the portal venous phase of enhancement, allowing for detection of renal parenchymal injuries. The ability of acquiring multiple phases may be beneficial in some cases. A delayed phase should be added if ureteral injury is suspected. If a vascular injury is suspected, vascular phase imaging may be useful.

In the trauma patient, rapid diagnosis of intra-abdominal hemorrhage is essential. Traditionally, diagnostic peritoneal lavage (DPL) was widely used for detecting intraperitoneal hemorrhage. DPL is sensitive, easy to perform, and universally available; however, it does not differentiate inconsequential bleeding from that which requires laparotomy and, more importantly, it cannot detect the site of the bleeding or retroperitoneal injuries. It is now considered an adjunct diagnostic method, particularly if intestinal and mesenteric injuries are suspected or if CT or ultrasound (US) is not available.

Ultrasound

Focused abdominal sonography for trauma (FAST), originally pioneered in Europe, is now widely used in many trauma centers in the United States and allows for rapid detection of intra-abdominal hemorrhage.

Advantages of FAST are that it can be performed rapidly at the patient's bedside, is noninvasive, and does not expose patients to ionizing radiation. The value of FAST in screening abdominal trauma patients has been recently confirmed by several large studies. One study reported that among 3,679 patients with negative findings on US, 99.9% were confirmed as true negative by clinical or radiographic follow-up. In another series of 4,029 patients suffering from blunt abdominal trauma, the accuracy of FAST was reported to be 95%. The authors concluded that hypotensive patients with positive FAST could be triaged directly to laparotomy, without need for CT. However, there is a statistically significant correlation between the presence of a falsely negative FAST US and an underlying pelvic fracture or a renal injury. While the role of FAST in the hemodynamically unstable trauma patient is well recognized, its utility in the hemodynamically stable patient is more controversial, as CT is usually required for precise delineation of underlying injuries. One potential limitation of FAST is that it requires the presence of a qualified sonographer and/or physician to perform and interpret the study.

With regard to evaluation of renal injuries, a significant limitation of US for imaging of renal trauma is that no functional information is provided. A review of the role of US in patients with renal trauma showed that only 22% of renal parenchymal abnormalities were identified prospectively and that abnormalities were detected more commonly with severe injuries. A more recent study of the role of US in diagnosing solid abdominal organ injuries reported a sensitivity of 45.7% and specificity of 64.1%. These numbers improve significantly if contrast-enhanced US is used; however, this technique is not available in the United States. There is little information concerning the use of color Doppler for assessing renal blood flow after trauma.

Intravenous Urography

In patients who are hemodynamically unstable, only limited information about the status of the urinary tract can generally be obtained. A single view of the abdomen following a large dose of intravenously administered contrast material ("one-shot" intravenous urography [IVU]) is generally all that can be obtained; such a study is insufficient to diagnose a renal injury but can give information about the location and status of the uninjured kidney(s) and verify function in the opposite kidney. The value of these limited "one-shot" studies in unstable patients has been questioned; a retrospective review of 239 such studies showed that the preoperative urographic assessment of contralateral renal function played no role in the management of a renal injury. The authors of this study felt that delaying definitive therapy merely to obtain the urographic study was not justified.

Penetrating Injury

In patients who are suspected to have suffered a penetrating renal injury, CT is also the method of choice for assessment. In patients with limited

posterior stab wounds, CT should be performed for assessment, since exploratory surgery is not mandatory.

In recent years, there has been a growing trend towards nonoperative management of renal injuries in the hemodynamically stable adult and pediatric patient. This practice is well established for managing blunt abdominal trauma and even after penetrating injuries in selective cases. CT thus becomes critically important for precise delineation of the nature and extent of injuries.

The management of patients with penetrating renal injuries remains more controversial, although even in these cases there is a developing trend towards conservative management. This paradigm shift can be in large part attributed to the accurate staging of such injuries that is provided by CT.

Renal Angiography and Embolization

Another important trend is the use of arteriography and embolotherapy for nonoperative management of persistent or life-threatening traumatic renovascular injuries. Although arteriography has a high degree of specificity in detecting the bleeder, it is usually performed as part of a therapeutic embolization and directed towards a suspected abnormality detected on contrast-enhanced CT. The additional contrast load administered during embolotherapy does not seem to have long-term impact on renal function. Embolotherapy has been shown to be safe and effective in the management of renovascular injuries and may be associated with shorter hospital stay compared to surgical intervention.

Both the Société Internationale d'Urologie and the European Association of Urology have published a consensus document on issues concerning the diagnosis and management of renal injuries. Their recommendations are not substantially different from those in this summary.

Summary

- Assessment of the nature and extent of the renal injury is most important in those patients in whom there will be an attempt to avoid exploratory surgery.
- In hemodynamically stable patients being assessed for wide-impact blunt injury in a major trauma center where CT is available immediately on a 24-hour basis, CT is the imaging method of choice and gold standard.
- In institutions where there would be a significant delay in obtaining high-quality CT, it is acceptable to use DPL or FAST to look for the presence of intraperitoneal fluid and "one-shot" IVU to assess the kidneys.
- In patients who suffer suspected anterior penetrating renal injury, CT should be used as a first-line study if radiographic assessment is desired. Similarly, CT is the study of choice to evaluate the effect of limited posterior stab wounds.
- The preferred treatment of patients with suspected isolated blunt renal injury is perhaps the most controversial issue. Most such patients do not have evidence of multisystem trauma but are suspected of renal injury because of hematuria. Studies have demonstrated that the incidence of significant renal injury in this group of patients is low, and that those with microscopic hematuria alone do not need any radiologic evaluation.

Abbreviations

- CT, computed tomography
- FAST, focused abdominal sonography for trauma
- US, ultrasound

Relative Radiation Level Designations

Relative Radiation Level*	Adult Effective Dose Estimate Range	Pediatric Effective Dose Estimate Range
O	0 mSv	0 mSv
☢	<0.1 mSv	<0.03 mSv
☢☢	0.1-1 mSv	0.03-0.3 mSv
☢☢☢	1-10 mSv	0.3-3 mSv
☢☢☢☢	10-30 mSv	3-10 mSv
☢☢☢☢☢	30-100 mSv	10-30 mSv
*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as “Varies.”		

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Renal trauma

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Emergency Medicine

Internal Medicine

Nephrology

Radiology

Urology

Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of radiologic procedures in the differential diagnosis and evaluation of renal trauma

Target Population

Patients with renal trauma

Interventions and Practices Considered

1. X-ray
    - Abdomen and pelvis

    - Intravenous urography
2. Computed tomography (CT) abdomen and pelvis
    - With contrast
    - Without contrast
    - Without and with contrast
3. Ultrasound (US)
    - Abdomen (focused abdominal sonography for trauma [FAST] scan)
    - Kidneys and bladder retroperitoneal
4. Arteriography kidney

Major Outcomes Considered

Utility of radiologic procedures in evaluation of renal trauma

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Procedure

The Medline literature search is based on keywords provided by the topic author. The two general classes of keywords are those related to the condition (e.g., ankle pain, fever) and those that describe the diagnostic or therapeutic intervention of interest (e.g., mammography, MRI).

The search terms and parameters are manipulated to produce the most relevant, current evidence to address the American College of Radiology Appropriateness Criteria (ACR AC) topic being reviewed or developed. Combining the clinical conditions and diagnostic modalities or therapeutic procedures narrows the search to be relevant to the topic. Exploding the term "diagnostic imaging" captures relevant results for diagnostic topics.

The following criteria/limits are used in the searches:

1. Articles that have abstracts available and are concerned with humans.
2. Restrict the search to the year prior to the last topic update or in some cases the author of the topic may specify which year range to use in the search. For new topics, the year range is restricted to the last 5 years unless the topic author provides other instructions.
3. May restrict the search to Adults only or Pediatrics only.
4. Articles consisting of only summaries or case reports are often excluded from final results.

The search strategy may be revised to improve the output as needed.

Number of Source Documents

The total number of source documents identified as the result of the literature search is not known.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Strength of Evidence Key

Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis, and results.

Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.

Category 3 - The conclusions of the study may be valid, but the evidence supporting the conclusions is inconclusive or equivocal.

Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author drafts or revises the narrative text summarizing the evidence found in the literature. American College of Radiology (ACR) staff draft an evidence table based on the analysis of the selected literature. These tables rate the strength of the evidence for all articles included in the narrative text.

The expert panel reviews the narrative text, evidence table, and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the table. Each individual panel member forms his/her own opinion based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Modified Delphi Technique

The appropriateness ratings for each of the procedures included in the Appropriateness Criteria topics are determined using a modified Delphi methodology. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. American College of Radiology (ACR) staff distributes surveys to the panelists along with the evidence table and narrative. Each panelist interprets the available evidence and rates each procedure. The surveys are completed by panelists without consulting other panelists. The ratings are a scale between 1 and 9, which is further divided into three categories: 1, 2, or 3 is defined as "usually not appropriate"; 4, 5, or 6 is defined as "may be appropriate"; and 7, 8, or 9 is defined as "usually appropriate." Each panel member assigns one rating for each procedure per survey round. The surveys are collected and the results are tabulated, de-identified and redistributed after each round. A maximum of three rounds are conducted. The modified Delphi technique enables each panelist to express individual interpretations of the evidence and his or her expert opinion without excessive bias from fellow panelists in a simple, standardized and economical process.

Consensus among the panel members must be achieved to determine the final rating for each procedure. Consensus is defined as eighty percent (80%) agreement within a rating category. The final rating is determined by the median of all the ratings once consensus has been reached. Up to three rating rounds are conducted to achieve consensus.

If consensus is not reached, the panel is convened by conference call. The strengths and weaknesses of each imaging procedure that has not reached consensus are discussed and a final rating is proposed. If the panelists on the call agree, the rating is accepted as the panel's consensus. The document is circulated to all the panelists to make the final determination. If consensus cannot be reached on the call or when the document is circulated, "No consensus" appears in the rating column and the reasons for this decision are added to the comment sections.

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for evaluation of patients with renal trauma

Potential Harms

There is a statistically significant correlation between the presence of a falsely negative focused abdominal sonography for trauma ultrasound (FAST US) and an underlying pelvic fracture or a renal injury.

Relative Radiation Level (RRL)

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

The American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

1996 (revised 2012)

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Urologic Imaging

Composition of Group That Authored the Guideline

Panel Members: Sheila Sheth, MD (*Principal Author*); David D. Casalino, MD (*Panel Chair*); Erick M. Remer, MD (*Panel Vice-chair*); Jay T. Bishoff, MD; Courtney A. Coursey, MD; Manjiri Dighe, MD; Steven C. Eberhardt, MD; Stanley Goldfarb, MD; Howard J. Harvin, MD; Elizabeth Lazarus, MD; John R. Leyendecker, MD; Mark E. Lockhart, MD, MPH; Paul Nikolaidis, MD; Aytekin Oto, MD; Christopher Porter, MD; Raghunandan Vikram, MD

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

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Guideline Availability

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 1 p. Electronic copies: Available in PDF from the ACR Web site.
- ACR Appropriateness Criteria® renal trauma. Evidence table. Reston (VA): American College of Radiology; 2012. 11 p. Electronic copies: Available from the ACR Web site.

Patient Resources

None available

NGC Status

This summary was completed by ECRI on March 25, 1999. The information was verified by the guideline developer on September 9, 1999. This summary was updated by ECRI on February 12, 2002. The updated information was verified by the guideline developer on March 25, 2002. This summary was updated by ECRI on March 8, 2006, December 4, 2007, June 18, 2010, and on May 9, 2013.

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